Separation, Concentration and Immobilization of Tc and Iodine from Alkaline Supernate Waste

Developer: Eichrom Industries, Inc.
Contract Number: DE-AC21-97MC33137
Crosscutting Area: ESP

Mixed Waste FOCUS AREA

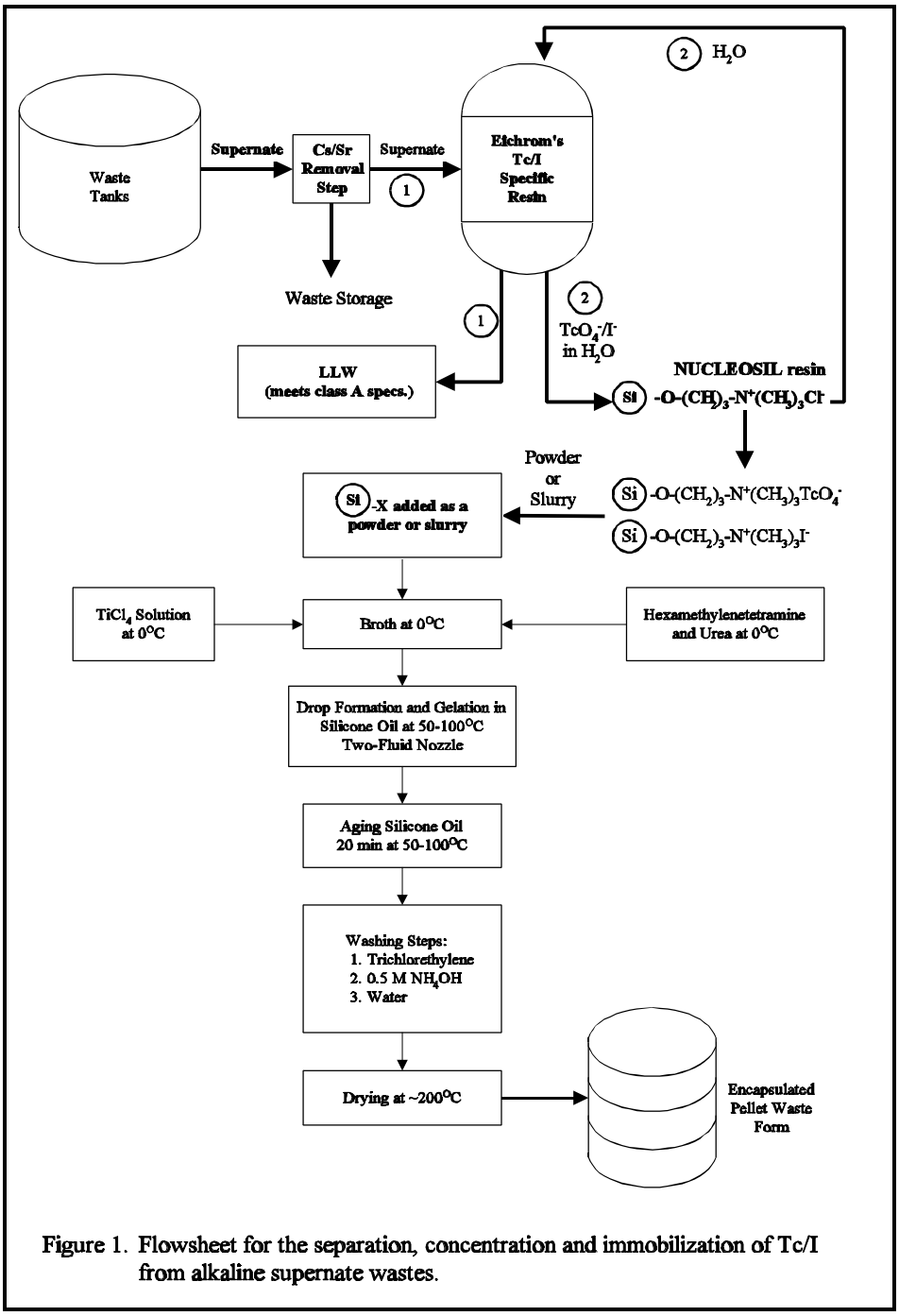

Figure 1. Flowsheet for the separation, concentration and immobilization of Tc/I from alkaline supernate wastes.

Problem:

Alkaline waste constitutes the largest portion of the high level waste (HLW) tank inventory at both Hanford and Oak Ridge National Laboratory (ORNL) Melton Valley. Nearly 160 million liters of liquid, alkaline waste are currently being held in either single- or double-shelled tanks at the Hanford site. The Melton Valley waste, estimated to contain 1.6 million liters of supernate, is similar in composition to alkaline supernate waste at Hanford and other Department of Energy (DOE) sites. The requirement of separation, concentration, and immobilization of technetium and iodine in alkaline waste presents a major challenge to the DOE remediation effort.

Solution:

Eichrom Industries, Inc. has licensed a new technetium (Tc) and Iodine (I) selective resin (ABEC) which meets the above-mentioned requirements. This new resin, based on aqueous biphasic partitioning, was developed jointly at Argonne National Laboratory and Northern Illinois University. It shows remarkable selectivity for Tc and I over matrix constituents present in alkaline

supernate. Most importantly, this resin has the unique advantage that Tc and I are elutable with water. The concentrated radioactive species, now present in water, can then be adsorbed onto a silica strong-base anion exchange resin. The silica resin is subsequently immobilized via an internal gelation process that seals the radioactive species inside a titania or zirconia shell. The flowsheet (Figure 1) depicts the complete process.

Benefits:

The ABEC resin is far less sensitive to the nitrate and nitrite concentrations present in the alkaline supernates than anion exchange resins. The ABEC resin can be stripped with water thereby eliminating the need for reductants, chelating agents, or other less benign stripping agents.

A minimum decrease of three orders of magnitude in the final waste volume will result from using the ABEC resin followed by encapsulation of the silica strong-base resin via internal gelation. This flowsheet is expected to have economic advantages over the other current technologies available for the removal of Tc/I from the alkaline supernates.

Technology:

The focus of this effort was to complete the development and scale-up of the ABEC resin and demonstrate its effectiveness in the separation and concentration of Tc and I. Further, loading of technetium and iodine onto the silica strong-base resin from water and encapsulation of the radionuclide loaded resin was tested. The effort was planned to take place in three stages. Phase I completed development and initial scale-up of the resin manufacturing to demonstrate technical and economic feasibility. It also investigated ABEC resin performance with waste simulants, uptake by the silica resin, and the encapsulation techniques to be employed.

Phase II was to demonstrate the ABEC resin's performance with actual tank waste and further optimize the encapsulation process. The final task of this option was to perform the engineering design for the pilot demonstration. Phase III was planned for a pilot demonstration at a site chosen by DOE.

Project Conclusion:

This project was completed in May 1998. Although the Base Phase was completed successfully, a decision was made not to continue the project due to a lack of DOE site interest for use of the developed ABEC resin. Potential end users at ORNL and at the RMI/Ashtabula site in Ohio were informed of the capabilities of this technology. RMI has decided to use another technology for removal of Tc from groundwater. ORNL has stated that the method they will use to treat their waste stream will eliminate concern for Tc, therefore, the ABEC resin will not be needed.

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